California Department of Food and Agriculture

***PEST EXCLUSION TRAINING MANUAL***

# *LESSON 7:*

## *Cotton Pests (Boll Weevil, Pink Bollworm) Gypsy Moth, and Imported Fire Ant*

Before beginning this lesson:

1. Thoroughly study:

   - Cotton Pest Exterior Quarantine (CCR 3254).
   - Pink Bollworm Federal Domestic Quarantine (CFR 301.52).
   - Gypsy Moth Federal Domestic Quarantine (CFR 301.45).
   - Imported Fire Ant Federal Domestic Quarantine (CFR 301.81).

2. Using the practice maps provided, indicate the areas under quarantine as listed in the above regulations.

3. Read the Detection Manual pages pertaining to the above pests.

4. View the following videotapes:

   - Fire Ant Date Viewed: _____
   - Pink Bollworm Date Viewed: _____
   - Asian Gypsy Moth Date Viewed: _____
   - Gypsy Moth Date Viewed: _____

## Boll Weevil
## *Anthonomus grandis*

**Order:** Coleoptera (beetles).
**Family:** Curculionidae (weevils or snout beetles).
**Range:** All cotton growing states from Texas to the East Coast. Sporadic infestations have been eradicated from California and Arizona.
**Hosts:** Cotton is the principal host, but other members of Malvaceae or Mallow family (hollyhock, hibiscus, kenaf, thespesia, and thurberia) are also known to be attacked.
**Nature of Damage:** The leaf-like bracts at the base of the squares are punctured by the adult boll weevils during feeding. This may cause the squares to prematurely open, turn yellow and die. The larva, or grub, which hatches from an egg deposited inside the boll, feeds extensively on the maturing cotton causing improper development, staining, and decay.
**Description: Egg:** Small; laid in blossom buds or squares; hatching in three to four days. **Larva:** Legless, white grubs with a brown head, wrinkled on the back and approximately 13 mm in length at maturity. **Pupa:** Found in a cavity of the cotton boll approximately 12 mm in length. **Adult:** A small, hard-shelled weevil (6-8 mm in length); yellowish, grayish or brownish in color, becoming nearly black with age and having a very definite snout about half as long as the remainder of the body. The most characteristic feature of the boll weevil is the two spurs, or teeth, near the end of the front femur (the inner one much longer than the other) and a single spur on the middle femur.

| Life Cycle | | |
|---|---|---|
| **Stage** | **Place** | **Time of Year** |
| Egg | Squares of bolls | Spring to fall |
| Larva | Squares of bolls | Spring to fall |
| Pupa | Squares of bolls | Spring to fall |
| Adult | Plant parts and debris | All year |

**Generations Per Year:** Up to seven.
**Most Likely Way of Introduction:** Cotton and cotton plants, all stages.
**Quarantine Summary:** CCR 3254; CFAC 6305 & 6461.5.


**Adult on Cotton**


**Boll Weevil Adult**

**Larva and Pupa**

## Pink Bollworm
## *Pectinophora gossypiella*

**Order:** Lepidoptera (butterflies and moths).
**Family:** Gelechiidae (gelechiid moths).
**Range:** Found throughout most cotton producing regions worldwide and believed to be a native of India. In the United States, infestations occur in Arizona, California, New Mexico, Texas, Oklahoma, Arkansas, Louisiana, and Florida.
**Hosts:** The preferred host is cultivated cotton, but okra is frequently infested. Infrequent hosts are other malavaceous plants such as hibiscus, althaea, and thespesia.
**Nature of Damage:** The small, pinkish larvae or caterpillars eat both lint and seeds of the cotton plant and thus reduce yield, weight, vitality and oil content of seeds. Infestation also reduces the quantity and quality of the lint. Severe infestations cause squares and small buds to shed.
**Description: Egg:** Small, approximately 0.5 mm in length; elongate-oval in shape; greenish white to reddish brown in color; laid singly or in groups of five to ten on the surface of the cotton plant; hatching in three to twelve days. **Larva:** Early instars are white with a dark brown head. With maturity, the larva develops two salmon-pink transverse dorsal bands. The full-grown larvae average 10 to 13 mm in length. When mature (approximately two weeks after hatching) the larvae emerge from the cotton boll, drop to the ground, and pupate. **Pupa:** Bright brown with a velvet pubescence and approximately 9 mm in length. Pupation generally occurs in the soil and may last from one to three weeks. **Adult:** A small dark brown moth with bluntly pointed forewings. The hind wings are sharply pointed at the leading edge with the posterior edge having a fringe of hair-like scales.

| Life Cycle | | |
|---|---|---|
| **Stage** | **Place** | **Time of Year** |
| Egg | In bolls | Spring |
| Larva | In bolls | Spring to summer |
| Pupa | In bolls | Late summer to spring |
| Adult | On ground, about plant | Spring |

**Generations Per Year:** One.
**Most Likely Way of Introduction:** As larvae in cotton bolls.
**Quarantine Summary:** CFR 301.52; CCR 3254 & 3409; CFAC 6305 & 6461.5.


**Adults and Larva**


**Pink Bollworm Adult**

## IDENTIFICATION OF COTTON AND OKRA

**Cotton**: Cultivated cotton belongs to the Genus *Gossypium* and wild cotton to *Thurberia*. Both belong to the family Malvaceae.

(a) *Gossypium* spp.

More than 20 species and many botanical varieties belong to this genus. They are typically stout annual or perennial shrubs. **Leaves:** Large; alternate; palmately lobed and veined; punctate (having translucent dots or pits); veins are very prominent; stipules are small and deciduous. **Flowers:** Regular; perfect; axillary; usually having parts in multiples of five; white to purple in color; stamens are many, forming a tube around the pistil; pistil often connected to petals. Ovary superior; single; 3- to 5-celled and sessile. Style club-shaped and undivided. Sepals often united as base. Involucel of three to seven bracts form the square or bud. **Fruit:** A capsule (boll); dehiscent; consisting of three to five cells (locks or locules). **Seeds:** Nearly smooth; black; generally fuzzy.

(b) *Thurberia* spp.

About the same as *Gossypium* but leaves are more deeply lobed and capsule is always three-celled.

**Okra** (*Hibiscus esculentus)*: Family Malvaceae.

Resembles cotton except:

(1) fruit is elongated, being three inches or more in length; and

(2) seeds are generally more lightly colored and smoother. Young pods are edible and used in making gumbo.

## INSPECTION OF COTTON AND OKRA

**Cotton:** Inspect bolls for evidence of larval and adult feeding (i.e., frass, stained cotton lint, exit holes, etc.). Break seed open, inspecting for larval presence.

**Okra:** Cut fruit lengthwise, checking for evidence of larval feeding.

Adults of these insects, particularly boll weevil, may be spread by several other means, including: in hay, Spanish moss, bark, and plant trash. Therefore, any of these commodities arriving from infested areas should be examined.

## Gypsy Moth
## *Lymantria dispar*

**Order:** Lepidoptera (moths and butterflies).
**Family:** Lymantriidae (tussock moths).
**Range:** Heavy infestations occur in southeastern Canada, the eastern seaboard south to the Carolinas and west to Michigan. Gypsy moth has been sporadically detected in all of the contiguous United States.
**Hosts:** Favored hosts include oak, birch, willow, poplar, apple, larch, linden, alder, box elder, roses and sumac. Many other deciduous and evergreen trees and shrubs are readily fed upon by older larvae. Has also been known to feed upon grasses and garden crops.
**Nature of Damage:** Caterpillars or larvae of these moths feed upon leaves of the host plant. Heavy infestations strip the trees of their foliage. Repeated defoliations of deciduous trees may kill them; one defoliation will kill an evergreen tree. Any defoliation will seriously weaken a tree and increase its susceptibility to attacks by other insects and plant diseases. A defoliated forest allows sunlight to enter and dry out the soil and destroy the humus. This degrades watersheds and increases fire hazard.
**Description: Egg:** Laid in compact clusters that are protected and covered by brown body hairs from the abdomen of the female moth. A normal cluster contains 400 to 600 eggs and is generally laid on the bark of the host tree, but is often deposited on any nearby object including fence posts, stones, vehicles, camping equipment and outdoor furniture. **Larva:** Sooty gray in color, with long still brown hairs along the sides, and two rows of blue and red hairs along the back; approximately 5 cm in length when fully grown; feeding mostly at night. **Pupa:** Reddish-brown to dark brown in color; approximately 2.5 cm in length; usually found attached in a secluded area, such as the underside of branches, under loose bark, under vehicles, etc. **Adult:** Gypsy moths are sexually dimorphic; the male being quite different from the female. The male is approximately 2.5 cm in length, with a wingspan of 4 cm, light brown-bodied with dark brown wings. The female cannot fly and is approximately 2.5 to 3.5 cm in length, with a wingspan of 5.5 to 6 cm, and a light buff body with white forewings. The female is merely an “egg-producing” organism and dies shortly after egg-laying. Neither sex feeds in the adult stage.

| Life Cycle | | |
|---|---|---|
| **Stage** | **Place** | **Time of Year** |
| Egg | On trees, stones, vehicles, etc. | July to May |
| Larva | Foliage of host plant | May to early July |
| Pupa | Sheltered places | First 2-3 weeks of July |
| Adult | About host plants | July to September |

**Generations Per Year:** One.
**Most Likely Way of Introduction:** As eggs transported on vehicles and other outdoor articles.
**Quarantine Summary:** CFR 301.45; CFAC 6305 & 6461.5.

## Asian Gypsy Moth

In Vancouver, British Columbia, in 1988, Agriculture Canada detected a strain of gypsy moth from Asia. This infestation is believed to have been caused by visiting Russian ships that were infested with egg masses of the Asian gypsy moth.

Although this gypsy moth is very similar to the gypsy moths found in the eastern United States, some very important differences do exist. Most importantly, the female of the Asian strain of gypsy moth is a strong flier (having a flight range of up to 30 kilometers), whereas the female of the North American strain is generally flightless. The female's ability to fly long distances enables the Asian strain to spread much more rapidly, of its own accord, than the North American gypsy moth. The larvae of the Asian gypsy moth demonstrate a greater host range than do those of the North American strain, and readily feed on larch, birch, willow, oak, and many other deciduous trees. All stages of the Asian gypsy moth closely resemble those of the North American gypsy moth, although the larvae do demonstrate highly variable color patterns.

## GYPSY MOTH INSPECTION

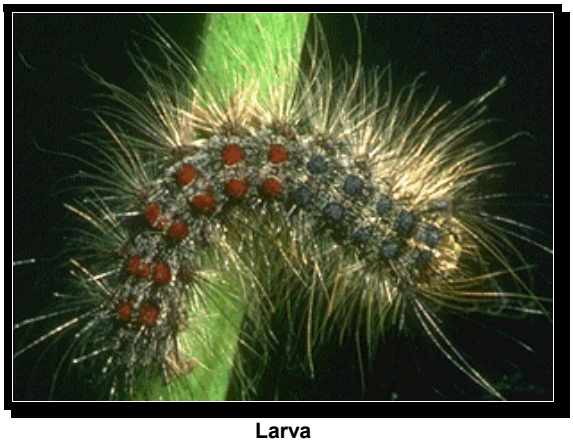
Gypsy moth eggs and pupae may be carried on any item that has been stored or used outside. Therefore, all outdoor items and vehicles, particularly those that may have been stationary for some time, should be inspected.

In general, the heaviest infestations seem to occur in the areas of least light and are attached in an area having a 90-degree angle. However, it should be kept in mind that any exterior surface may harbor gypsy moth egg masses. Therefore, careful inspection is required.

Infestations of live gypsy moth life stages should be removed by hand when found on smaller objects, or by means of hot water cleaner in the case of large items and vehicles. For more information on gypsy moth inspections, refer to Quarantine Commissioners Circular No. 207.

Many other insects, including tent caterpillar, white-marked tussock moth, and bag worm are often found while performing gypsy moth inspections. These insects may pose a threat to California agriculture and forests and should be removed from the vehicle or outdoor article and sent to the lab for identification.

**Adult Gypsy Moth (female) with Egg Mass**



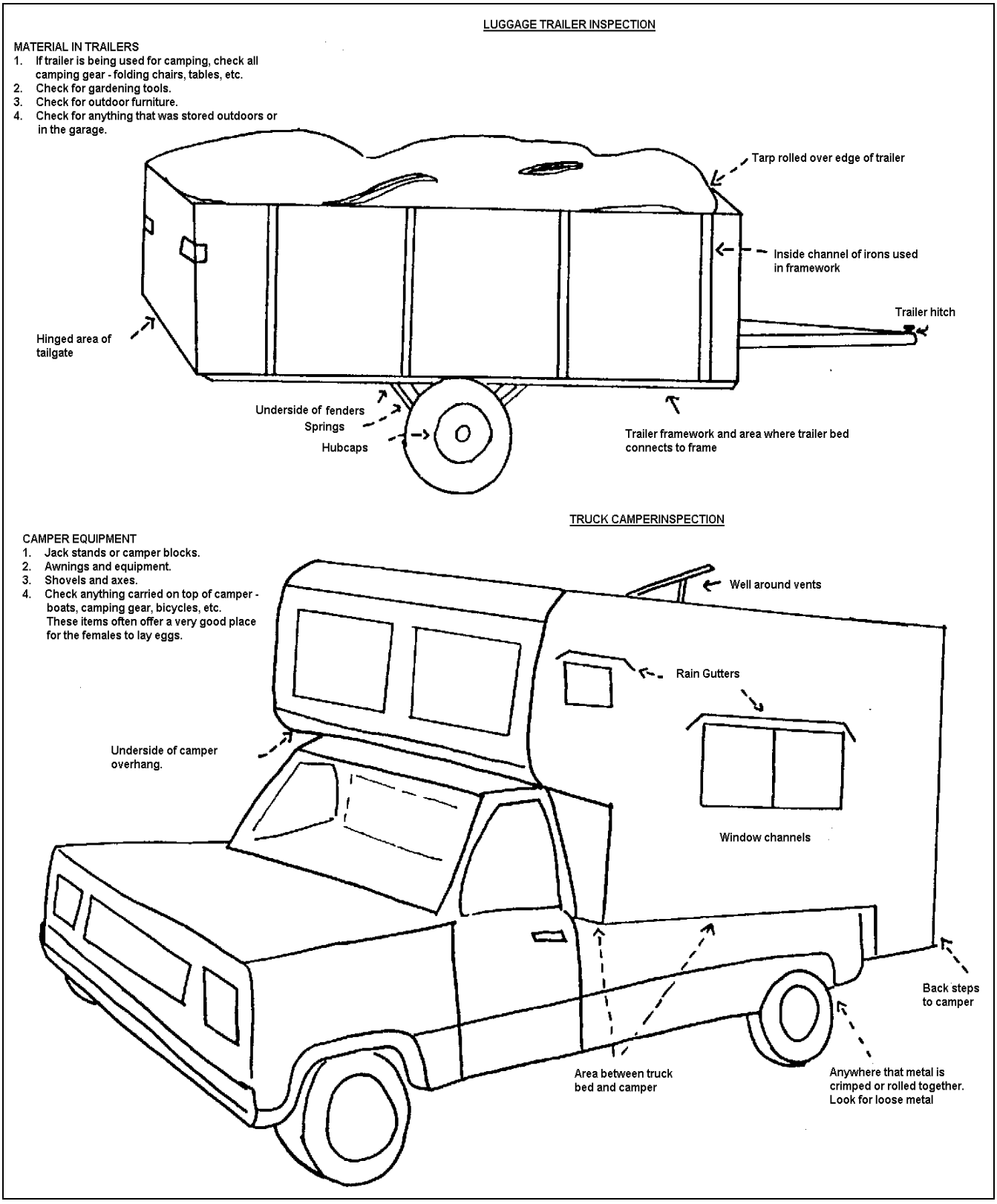
**Larva**

**Pupa and Larva**

**Adult Male**

## Gypsy Moth Inspection

Utility Trailers and Campers

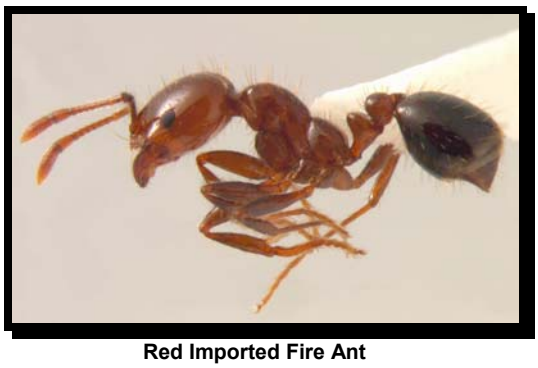


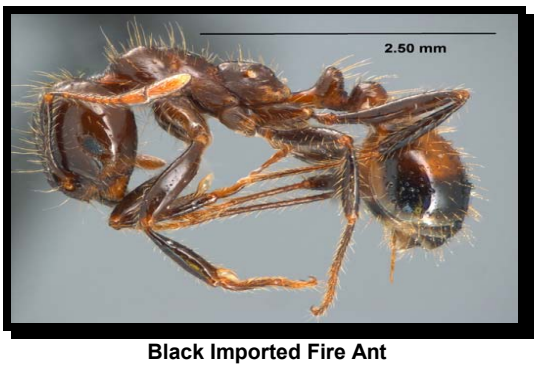
**Imported Fire Ants**
**Black Imported Fire Ant - *Solenopsis richteri***
**Red Imported Fire Ant - *Solenopsis invicta***

**Order:** Hymenoptera (sawflies, ants, wasps and bees).
**Family:** Formicidae (ants).
**Range:** Southeastern United States, westward to, and including, Texas.
**Hosts:** The ants feed on many kinds of plant and animal life. Colonies are generally established in open fields or along the edges of wooded areas.
**Nature of Damage:** Adult feeding on seeds and young plants damages many crops. Young, unprotected animals and newly hatched birds and poultry are often attacked and killed. The fire ant's sting is very painful and annoying to man and other larger animals. The ants may prevent the hand harvest of crops and their large mounds can be damaging to field machinery.
**Description: Egg:** The smooth, shiny white eggs are laid and fertilized by the queen in galleries of the mound. **Larva:** Larvae are dirty white, legless, and sparsely covered with hairs. They develop inside the mound within about nine days. **Pupa:** Pupae are shiny white and approximately the same size as adults. They are also found within the mound. **Adult:** May be either sexual (queens and drones) or non-sexual (workers) in nature. The sexual types are winged, with the queens being approximately 9 mm in length and reddish in color. The drones are approximately 5 mm long and black in color. The wingless workers, which are most often seen, range from 2.5 mm to 6 mm in length. Workers of *S. richteri* are reddish-brown to black with a distinct orange band on the dorsal side of the abdomen. Workers of *S. invicta* are lighter, being reddish to orange in color. This species also has an orange band on the abdomen, but it is not as distinct.

| Life Cycle | | |
|---|---|---|
| **Stage** | **Place** | **Time of Year** |
| Egg | In chambers within the mound | Spring to fall |
| Larva | In chambers within the mound | Spring to fall |
| Pupa | In chambers within the mound | Spring to fall |
| Adult | Foraging - excavating | All year |

**Generations Per Year:** Up to seven.
**Most Likely Way of Introduction:** In soil with infested nursery stock; or on farm or other infested machinery.
**Quarantine Summary:** CFR 301.81, CFAC 6461.5 & 6305.


**Red Imported Fire Ant**



**Black Imported Fire Ant**

**IMPORTED FIRE ANT INSPECTION**

On plants, look for workers on leaves and stems. The soil surface should also be checked. If the weather is cool, the ants may not be active. Tap on the side of the plant container. This will agitate ants and bring them to the surface. Check soil and roots for the presence of eggs, larvae, pupae, and adult sexual forms.

Almost any vehicle or commodity is potentially a host for hitchhiking imported fire ants. Whenever possible, all trailers and commodities coming from infested areas should be inspected for this pest.

Points to remember are:

- Truck trailers that have been hauling fire ant-infested materials are also likely to become infested. Trailers entering from infested areas should be given close visual inspection. Cracks in trailer sidewalls and other secluded places are excellent hiding places for fire ant colonies.

- Ants may survive in trailers hauling frozen commodities and emerge when conditions warm up.

- Many commodities including hay, straw, packing material, pallets, pipe, shingles, lumber, and farm machinery that are stored on the ground near imported fire ant infestations may become incidental hosts. These items should be inspected for soil contamination and ants.